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Ice Storm Project Summary

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INTRODUCTION

In January 1998, a major ice storm paralyzed portions of the northeastern United States and southeastern Canada, coating trees with as much as three inches of ice. The storm caused extensive damage to both human and forest communities alike. In New Hampshire, the most severely affected areas were upland hardwood forests in the White Mountain region and in the west-central and northern portions of the state. In these areas, the crowns of many hardwood trees were broken, and many young trees were severely bent as a result of the ice storm.

Assessments of damage zones from the January 1998 ice storm indicated that the storm could have impacted nearly 500 rare plant populations and exemplary natural communities in 90 New Hampshire towns. Of these, 196 occurrences lay within the White Mountain National Forest, nearly 100 were on other publicly owned lands, and more than 200 others were on private lands. The effects of the storm on these rare species and communities were unclear, and it was a priority for the NH Natural Heritage Inventory (NH Heritage) in 1999 and 2000 to assess the condition and identify necessary management actions for as many of them as possible. The New Hampshire Division of Forests and Lands (NH DFL) initiated an assessment specifically for ice-damage areas on private lands, with funding provided by the U.S. Forest Service (USFS). Because federal funding for ice-storm work on public lands was not available for NH Heritage surveys, public lands were outside the scope of this project.

This document is a summary of NH Heritage's 1999 and 2000 surveys of rare plant populations and exemplary natural communities within areas potentially damaged by the 1998 ice storm. Inventories of rare plant populations and natural communities within ice-damage areas occurred within the context of several USFS-funded studies regarding the effects of the 1998 ice storm. Other work in New Hampshire includes ongoing aerial surveys and assessments of damage areas, the implementation of cost-share assistance programs for timberland landowners, the creation of a community grants program in the nine ice-storm-affected counties, and improvements to state fire and safety programs, among other projects.

This project falls within NH Heritage's mandate by the New Hampshire Native Plant Protection Act (NH RSA 217-A:4) to conduct investigations on rare plants and their habitats to determine population conditions and protective measures necessary for their survival. The project is also helping NH DFL meet objective 5-4 of the NH Forest Resources Plan: to monitor and track forest health in a manner that builds on existing programs and establishes baseline data across ecological conditions (NH DFL 1996).

METHODS

To select appropriate survey sites, we searched the NH Heritage database for occurrences of rare plant populations and exemplary natural communities on private lands within flight-defined and

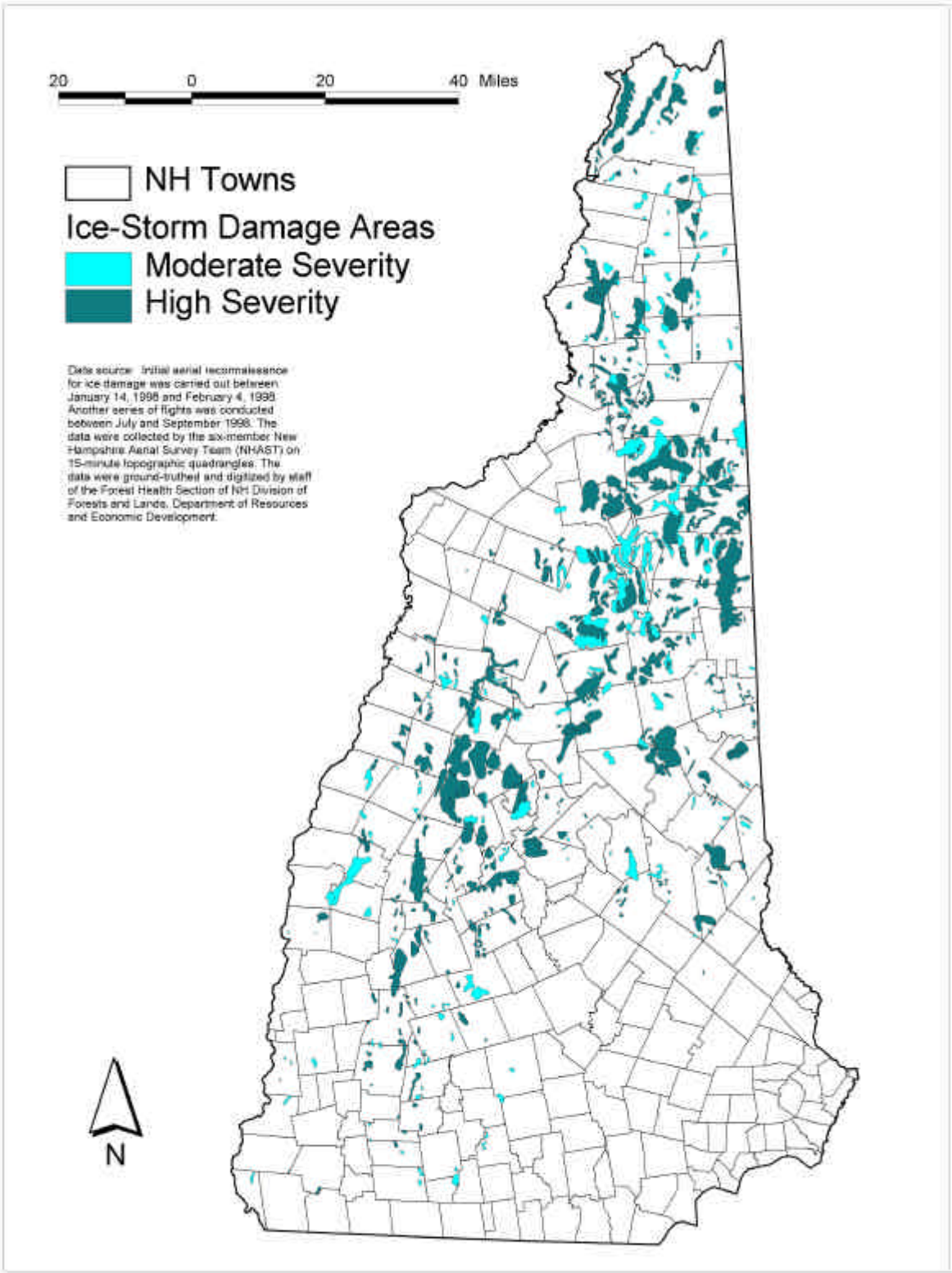

Figure 1. Ice-storm damage areas, coded by severity, as determined in 1998 by the Division of Forests and Lands. Polygons were drawn based on aerial surveys performed at elevations of ca. 1300 feet above the terrain and with flight lines ca. 4 miles apart. Low-severity areas were delineated within specific elevation ranges and are not depicted on this map.

elevation-defined ice-damage zones in New Hampshire (NH DFL 1998).[1] Figure 1 shows the distribution of the flight-defined ice-damage zones. Because some records in the database are based on historical data and therefore may not be mapped as precisely as more current records, we added buffers (not shown in Figure 1) to the flight- and elevation-defined zones to avoid missing records at the edges of these zones. These buffers also address the fact that the ice-damage zones do not have discreet boundaries on the ground, and plants and natural communities occurring just outside a mapped boundary may still be within smaller pockets of ice damage.

After identifying occurrences of rare plant populations and exemplary natural communities within ice-damage zones, NH Heritage used a process called landscape analysis to prioritize sites for survey during the 1999 and 2000 field seasons. In order to increase the efficiency of field visits to selected study areas, we prioritized sites based on the likely extent of ice damage, the precision of information available for relocating known rare plant populations and exemplary natural communities, and the number of occurrences at each location. To identify site characteristics that may influence ecological processes, and therefore plant and natural community patterns, we consulted surficial geology maps, bedrock geology maps, and U.S. Geological Survey (USGS) topographic quadrangles. We reviewed aerial photographs for some locations to determine broad vegetation patterns and conditions and assessed historical land use information when available. We then categorized selected sites as high, medium, or low priority for field surveys, depending on the projected likelihood of relocating known occurrences of rare plant populations and exemplary natural communities within areas of significant ice-storm damage.

LANDOWNER CONTACT

NH Heritage policy dictates that we obtain landowner permission to undertake field surveys on private lands. We therefore attempted to contact private landowners of all high- and medium-priority study sites. Land ownership was determined by consulting tax maps at town halls. Owners of parcels within, and sometimes adjacent to, site areas were sent a letter explaining our study, a fact sheet describing NH Heritage, and a self-addressed stamped postcard on which they could grant or deny permission for surveys. Great care was taken to conduct field surveys only on properties for which permission was granted.

FIELD SURVEY

Data were collected at specific locations (Observation Points or OPs) within each rare plant population area and exemplary natural community. The following information was collected at most observation points:

- natural community type;
- releve plot (10-400 m^2, depending on vegetation structure), including estimated percent cover of all plant species by vegetation layer (stratum) and growth form (canopy trees, subcanopy trees, tree seedlings/shrubs, herbs);
- information regarding size, area, and viability of rare plant populations;
- average diameter-at-breast height (DBH) of canopy trees, and tree cores in selected communities;

[1] Areas within the following elevation ranges were defined by the NH DFL to be highly probable areas for additional scattered damage: (1) Coos County, 1600 to 2400 ft.; (2) Carroll and Grafton Counties, 1300 to 1900 ft.; and (3) all other counties, 1500 to 1900 ft.

- relative extent of ice damage, based on a qualitative assessment of downed wood (low, moderate, high); an assessment of crown damage (in categories of 0-25%, 25-50%, 50-75%, and 75-100%); and an estimate of percent canopy cover; and
- other descriptive notes, including physical site characteristics, evidence of human disturbance, and wildlife evidence.

Field data and site locations of rare plant populations and exemplary natural communities have been catalogued and mapped in the NH Heritage database. Most plants were identified in the field during the inventory; otherwise, they were collected and keyed out using the resources available at NH Heritage.

Where feasible depending on weather conditions, satellite availability, and canopy density, we mapped the location of each rare plant population and natural community using a hand-held Global Positioning System (GPS) unit. Both the GPS data and mapping information recorded on USGS topographic quadrangle maps in the field were used to map rare plant populations and exemplary natural communities, using Geographic Information System (GIS) software at the NH Heritage office.

LIMITATIONS OF STUDY

Surveys of rare plant populations were limited at times by the precision of information available regarding their locations. In some cases, NH Heritage records of plant populations are based on herbarium specimens, which may date to the late 1800s or early 1900s. For these records, location information may be accurate only to a square mile area. Because of this limitation, we were unable to relocate several historically recorded populations. We also did not survey all rare plant populations or exemplary natural communities in aquatic or other treeless habitats that were not likely to have been impacted by the 1998 ice storm.

Selection of the rare plant populations and exemplary natural communities inventoried during this study was based on broadly defined ice-damage zones. Given mapping constraints and the highly patchy nature of the ice storm, it is unlikely that all occurrences of rare plants or exemplary natural communities in mapped or elevation-defined ice-damage zones would have been impacted by the 1998 ice storm. These selection criteria were judged to be conservative: occurrences that did not happen to be damaged would be included, but it is unlikely that occurrences that experienced significant damage were excluded.

Qualitative assessments of the condition of rare plant populations and exemplary natural communities in ice-storm damage areas, conducted in 1999 and 2000, were based on visual observations and percent cover estimates interpreted in the context of available information regarding the biology of the plant species and the ecology of the natural communities in which they occur. Quantitative evaluation of the impacts of a disturbance such as the 1998 ice storm on rare plants and communities would have required more detailed data collection immediately before and periodically after the disturbance.

ICE-STORM DAMAGE ASSESSMENT

OVERVIEW

On average, ice-storm damage affecting inventoried rare plant populations and exemplary natural communities on private lands in New Hampshire was fairly low. Approximately half of the rare plant populations and exemplary natural communities surveyed occurred in areas of some ice damage; however, only in 9% of the communities and 19% of the plant populations was ice-storm damage considered moderate/high. A total of 46% of communities and 31% of plant populations occurred in areas of low/moderate ice damage, and for the remainder of examples, ice-storm damage was assessed as minimal/none.

Overall, ice damage may have been low in the areas surveyed for several reasons. Many rare plants and exemplary natural communities typically do not occur in the common hardwood forest areas most heavily damaged by the ice storm. Rarities often occur in specialized habitats without extensive hardwood cover, such as cliffs, rock outcrop areas, or peatlands, or in forested small-patch communities limited to localized portions of the landscape, such as seepage swamps. Even when these kinds of rarities occurred within mapped ice-damage zones, they did not always experience the moderate or high ice damage visible in surrounding matrix communities. Damage from the 1998 ice storm was patchy, and as a result, mapped zones of moderate and high damage sometimes included sections of forest with lower levels of impact.

As described above, the impacts of the 1998 ice storm were initially assessed at a landscape scale using both aerial mapping and elevation-defined damage zones (NH DFL 1998). Because areas of low damage were particularly patchy and less easily mapped through visual surveys, however, they were instead defined by elevation bands considered particularly likely to contain additional scattered damage. Because ice damage was much less consistent in these areas, many rare plant populations and exemplary natural communities located in elevation-defined ice-damage zones exhibited little or no impact from the ice storm.

ASSESSMENT IN AREAS OF MODERATE/HIGH ICE DAMAGE

Although damage from the 1998 ice storm was low on average for surveyed rare plant populations and exemplary natural communities, it was moderate to high for some examples. Rare plant species typical of hardwood forest or woodland habitats appeared more likely to have experienced moderate or high damage in the surrounding community than did species that commonly occur in more open communities, such as ridgetops or some wetlands. Correspondingly, upland hardwood forest or woodland communities appeared more likely to have undergone significant impact from the ice storm than were wetland, ridgetop, or conifer-dominated communities.

While ice damage was assessed as moderate/high within the population areas of some rare plant species, in most of these cases, we did not detect evident negative effects of the associated canopy gaps and downed wood on the rare plants themselves. Inventoried rare plants were generally healthy. Because the populations of rare plant species may frequently be small, the small sizes of some populations could not be attributed to the ice storm, in the absence of detailed quantitative assessments both before and after the disturbance. Within the population areas for some species, large canopy gaps were correlated with a high density of early-successional plant species, such as fringed bindweed (*Polygonum cilinode*) or blackberries (*Rubus* spp.); however, the rare plant species in these areas, such as squirrel-corn (*Dicentra canadensis*) and millet-grass (*Milium effusum*), appeared to be growing successfully. While direct effects of the ice storm on these populations were not evident during our surveys, some concern remains about possible long-term effects on rare plant populations and exemplary natural communities.

Other rare plant species were affected but did not appear to be severely impacted by wood downed by the 1998 ice storm. For example, several plants in a population of three-bird orchid (*Triphora trianthophora*) in Wakefield were observed growing successfully under a large pile of downed wood. In Albany, fallen branches covered ca. 10-20% of a population of giant rhododendron (*Rhododendron maximum*), but obvious negative impacts were limited to ca. 5% of the colony. It is important to note that these observations are based on single site visits, available information on the biology of the plants, and our understanding of the communities in which they occur. Specific conclusions regarding the effects of a disturbance such as the 1998 ice storm on rare plant populations would require detailed data collection immediately before and periodically after the event.

MANAGEMENT CONSIDERATIONS

Because ice-storm damage associated with known and newly discovered rare plant populations and exemplary natural communities on private lands in New Hampshire was low on average, management considerations associated with the impacts of the ice storm on these rarities are minimal. Where moderate/high damage from the 1998 ice storm was observed, management did not appear to be necessary for the maintenance of the plant populations or communities at these sites. The most likely management activities in ice-storm-damage areas would be removal of downed wood or efforts to prevent early-successional plant species from encroaching on the population areas of rare plants. At most locations, however, these kinds of management activities appeared unnecessary and more likely to negatively impact rare plant populations, through associated trampling and soil disturbance, than did the ice storm itself.

Of greatest importance in effective management and protection of rare plant populations and exemplary natural communities in New Hampshire is increased understanding of the ecological processes associated with them. Periodic reassessment of permanent plots established and sampled at several sites during this project is one tool that could improve our understanding of the successional dynamics associated with these natural communities and the rare plants that occur within them.

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